



Virtualization and System of Systems Testing

**Capt Donnie Mayo
Marine Corps Tactical Systems
Support Activity (MCTSSA)**

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Agenda



- Virtualization Intro
- General Benefits
- Virtualization in the Corps
- Testing virtualization or testing with virtualization
- The Future



Virtualization Introduction



- Virtualization is the abstraction of the real hardware of a real, physical, computer system, often a server, in order to allow for the sharing of that hardware among more than one virtual computer system.



Virtualization Overview

Guests

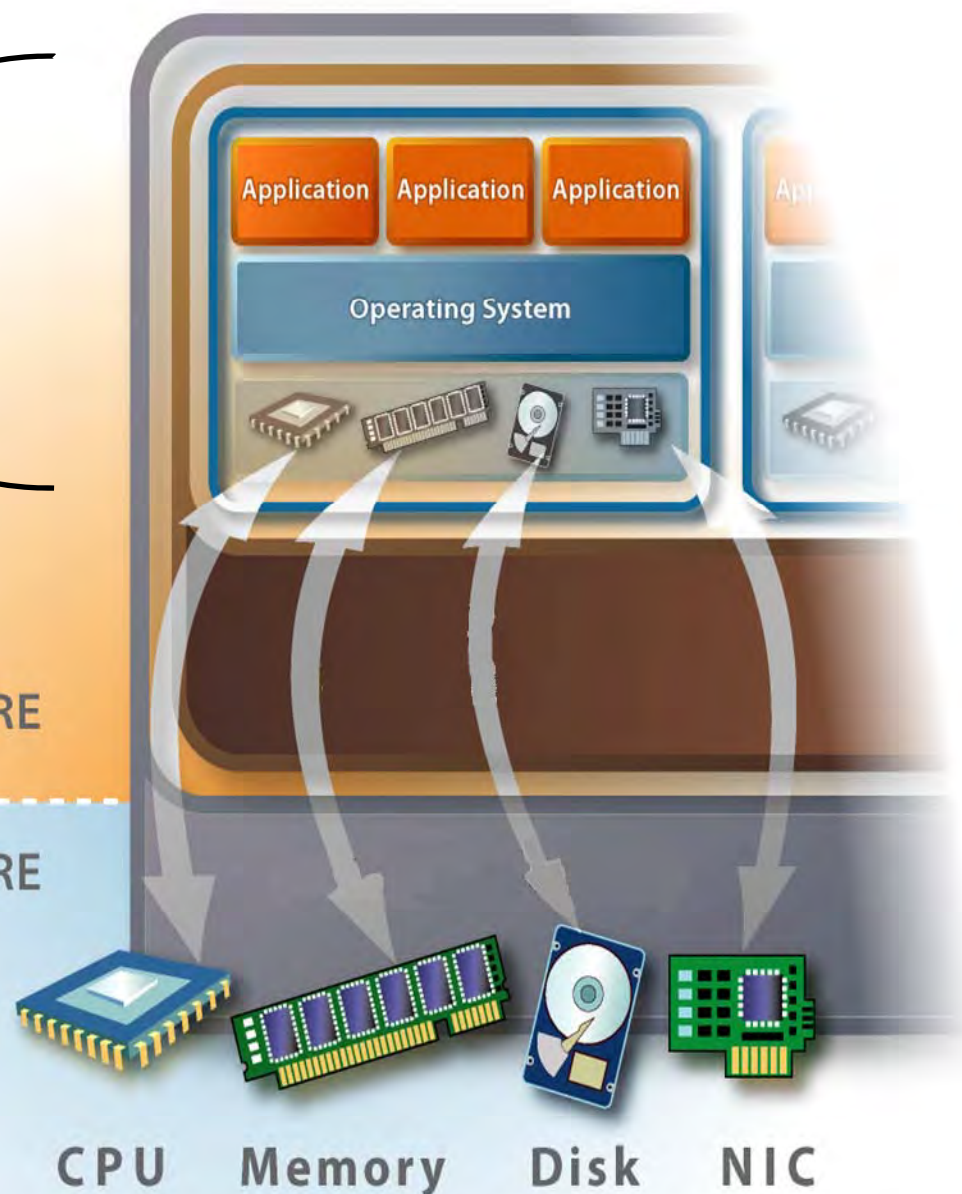
Virtual
Machines
(Clients and
Servers)

Host

Real
(Physical)
Server and
Host
Software

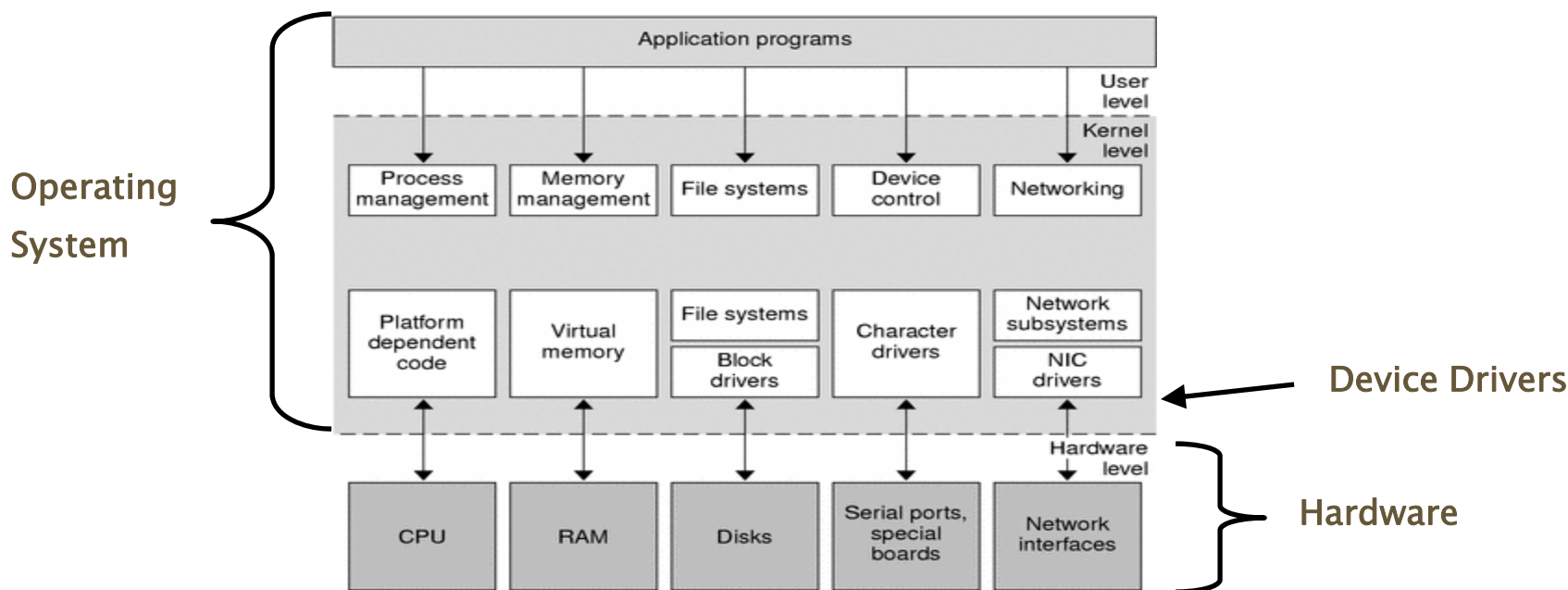
SOFTWARE

HARDWARE





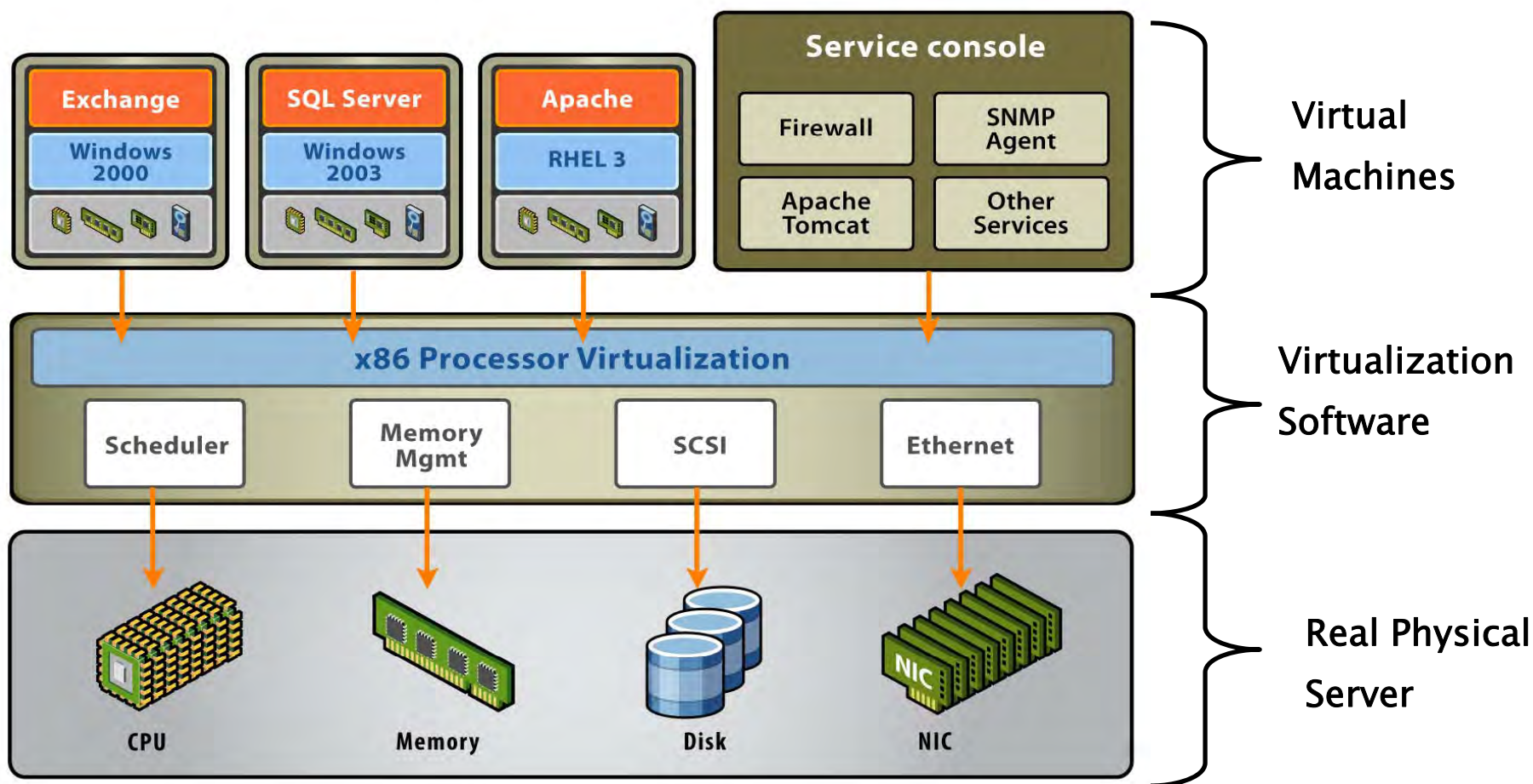
From the Guest Operating System Point of view



- A VM works just like a regular computer.
- Virtual machine's device drivers are replaced by device drivers that call virtual hardware instead of real hardware (but it does not know that the hardware is virtual)



From the Host Operating System Point of View





Virtualization Benefits

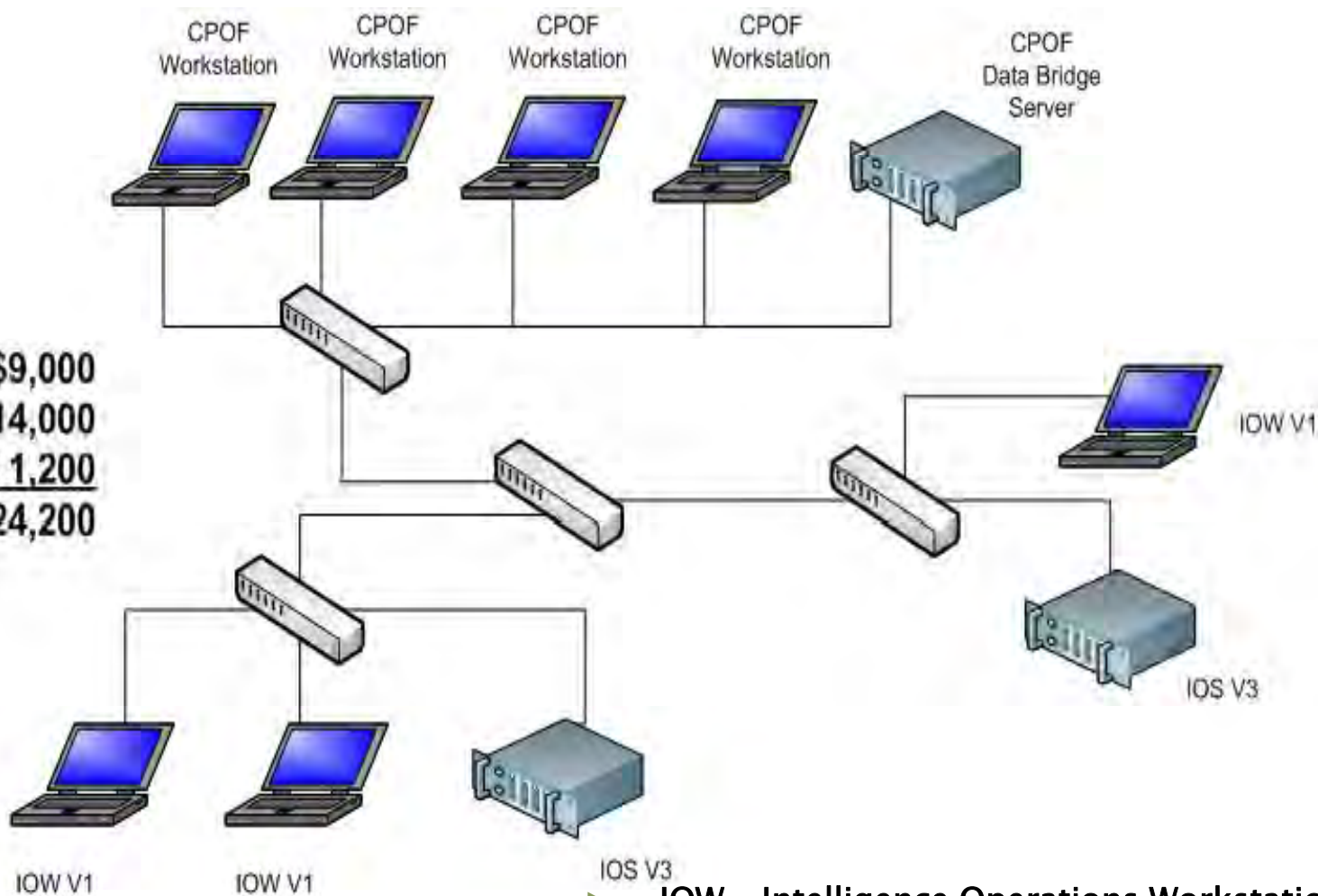


- More capability per piece of server hardware
- Disaster recovery/continuity of operations
- Greater training capability
- More efficient testing



COC CapSet 2 Before Virtualization

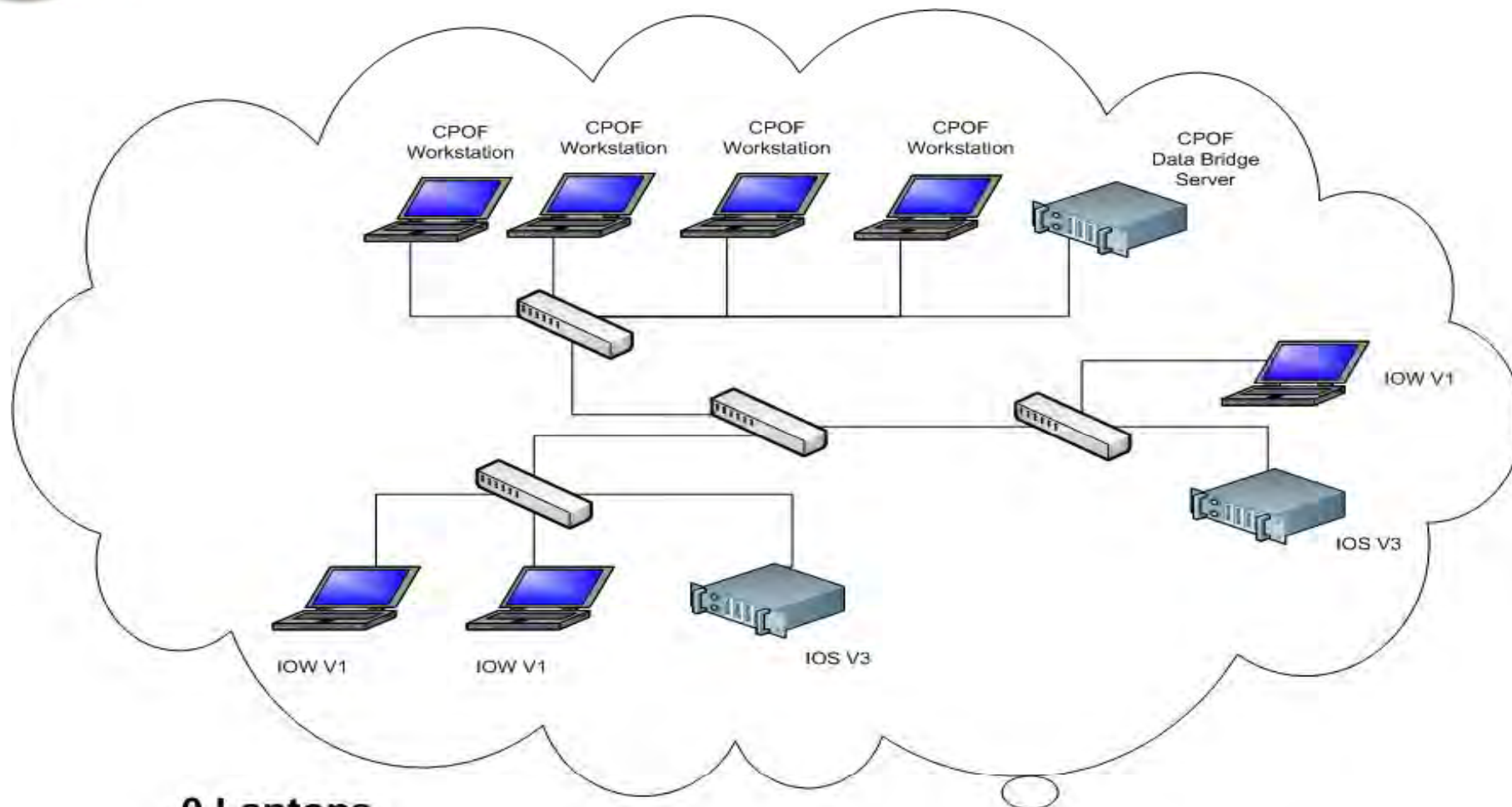
3 Servers -	\$9,000
7 Laptops -	\$14,000
4 Switches -	\$ 1,200
Total	\$24,200



- IOW – Intelligence Operations Workstation
- IOS – Intelligence Operations Server
- CPOF – Command Post of the Future



COC CapSet 2 After Virtualization



0 Laptops
0 Switches
1 Server - \$5,000
1 Terminal \$500
Total \$5,500



*** Still not at
Server Capacity**



Disaster Recovery



- Most virtualization solutions provide a variety of methods to increase the ability to recover from disaster.
- vMotion, Live Migration
- Fault Tolerance
- High Availability
- Most assume VMs are running on some sort of robust shared storage (NAS, SAN etc...)

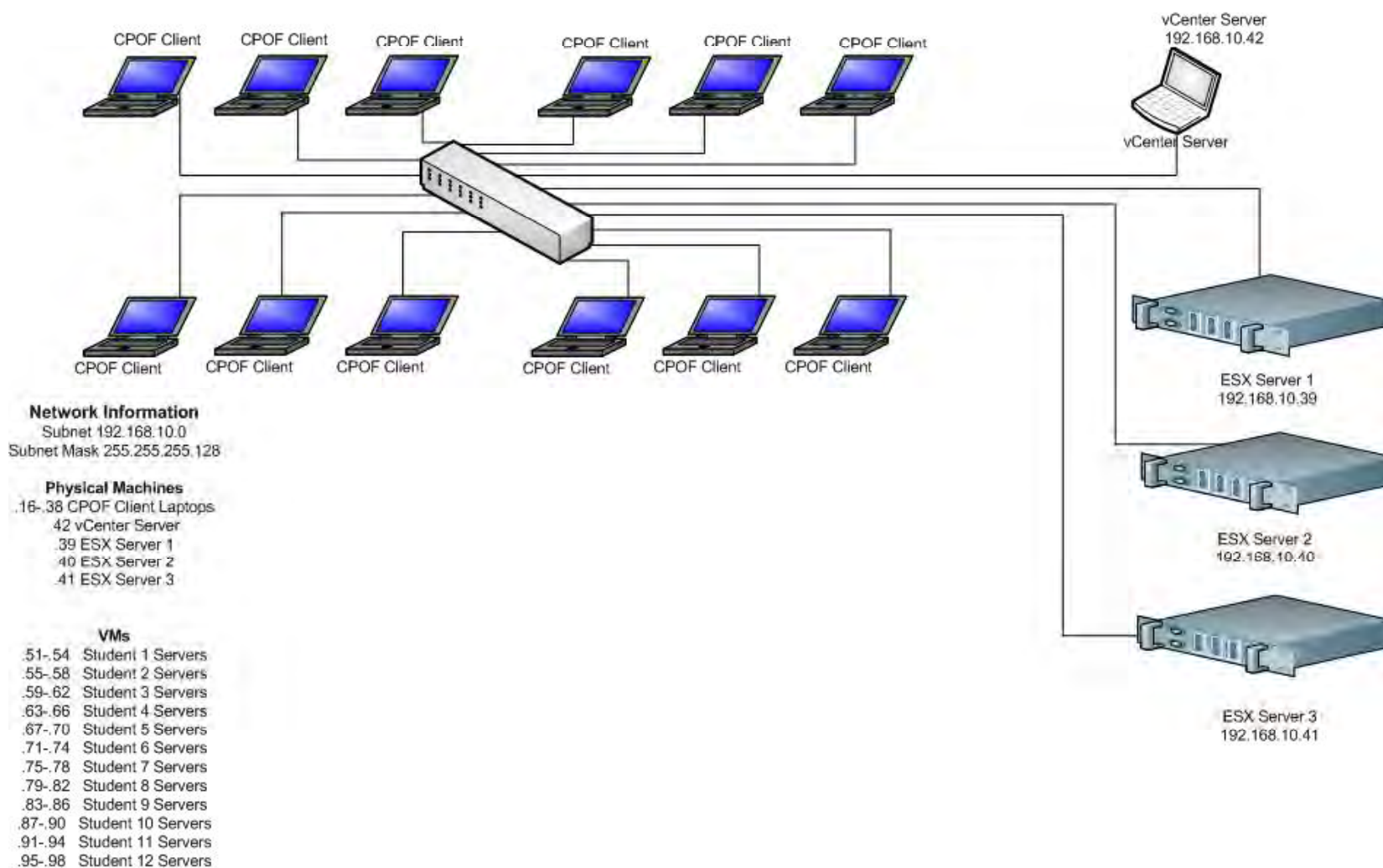


Greater Training Capability

CPOF Training Network Diagram

12 May 2009

Primary POC Mimi Chung 760-725-0657





Test Benefits

- Less people and physical gear to run tests
 - One person can run multiple virtual machines.
 - Hardware limitations are a huge problem as we get more missions and the same funding.
- Easily set up lab and test environment
 - More rapid setup of test network architecture & virtual machines
 - Test thread development and vetting
 - Redline test procedures and dry run testing
 - Simulation/Stimulation
 - Network data capture and analysis much the same



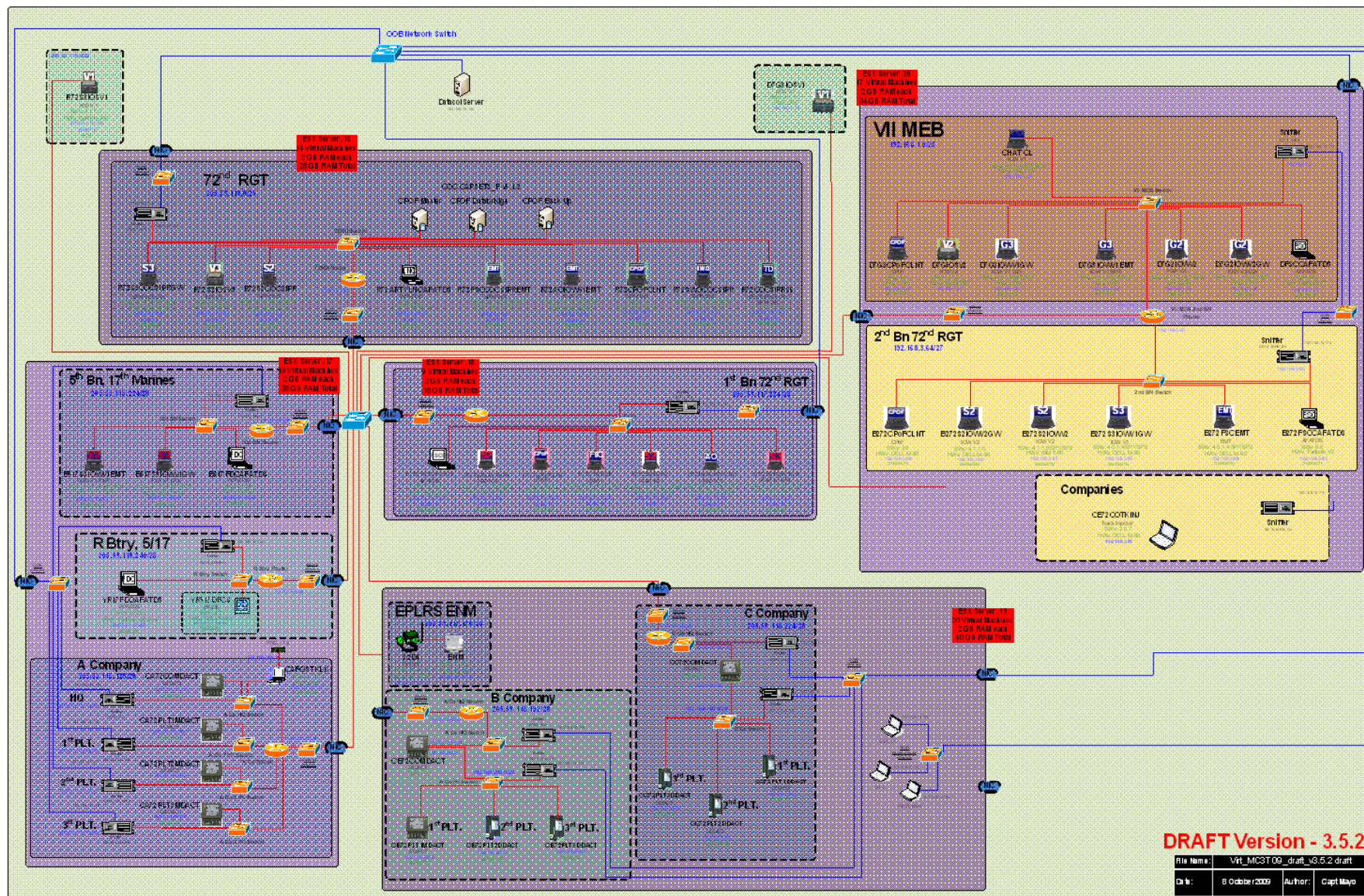
Real World Example

DRAFT Version - 3.5.2

For Official Use Only

MC3T Virtualization Proof of Concept Test Environment Topology

For Official Use Only



DRAFT Version - 3.5.2

File Name: VIT_MC3T09_draft_v3.5.2.draft

Date: 8 October 2009 Author: Capt Mayo

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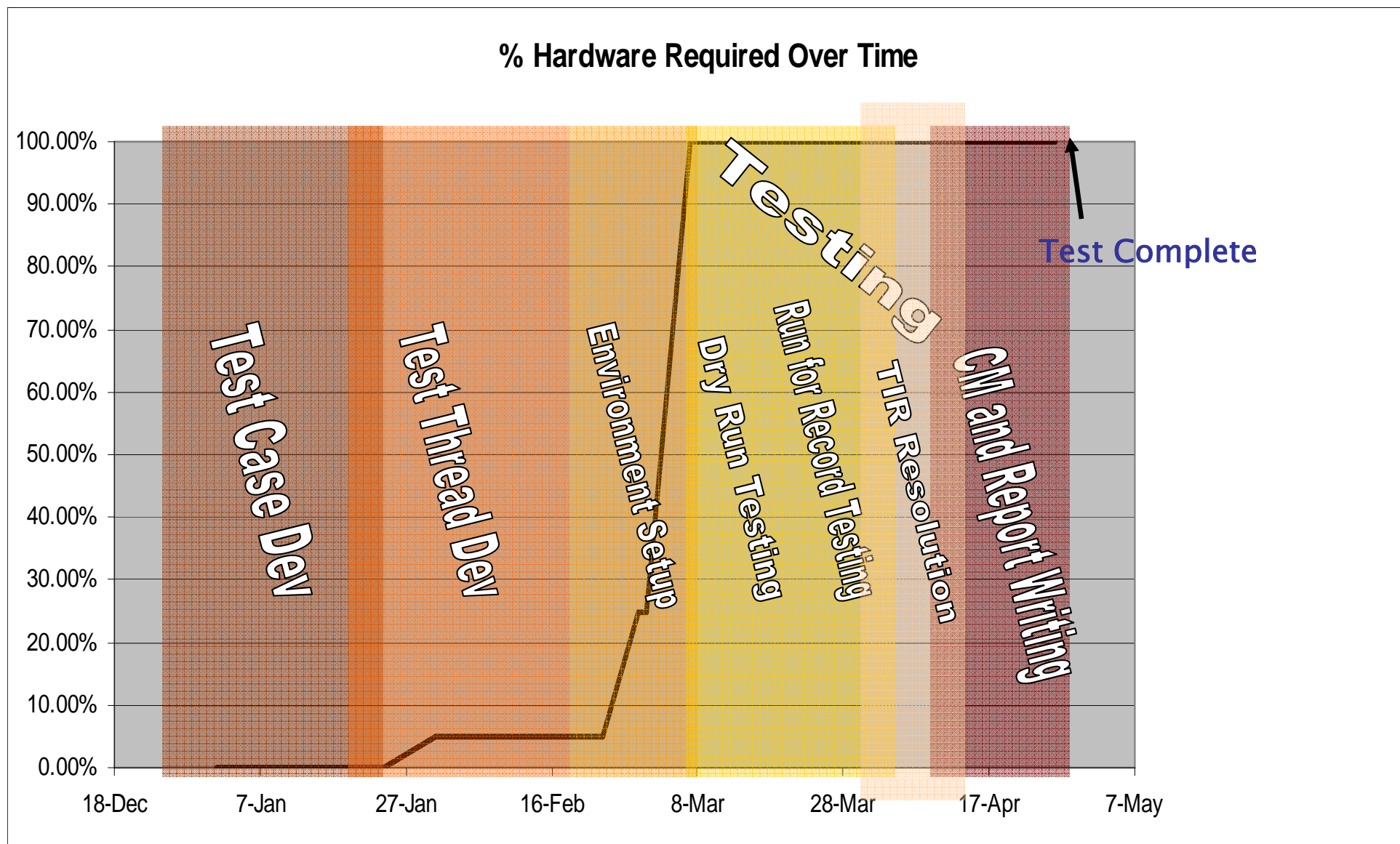
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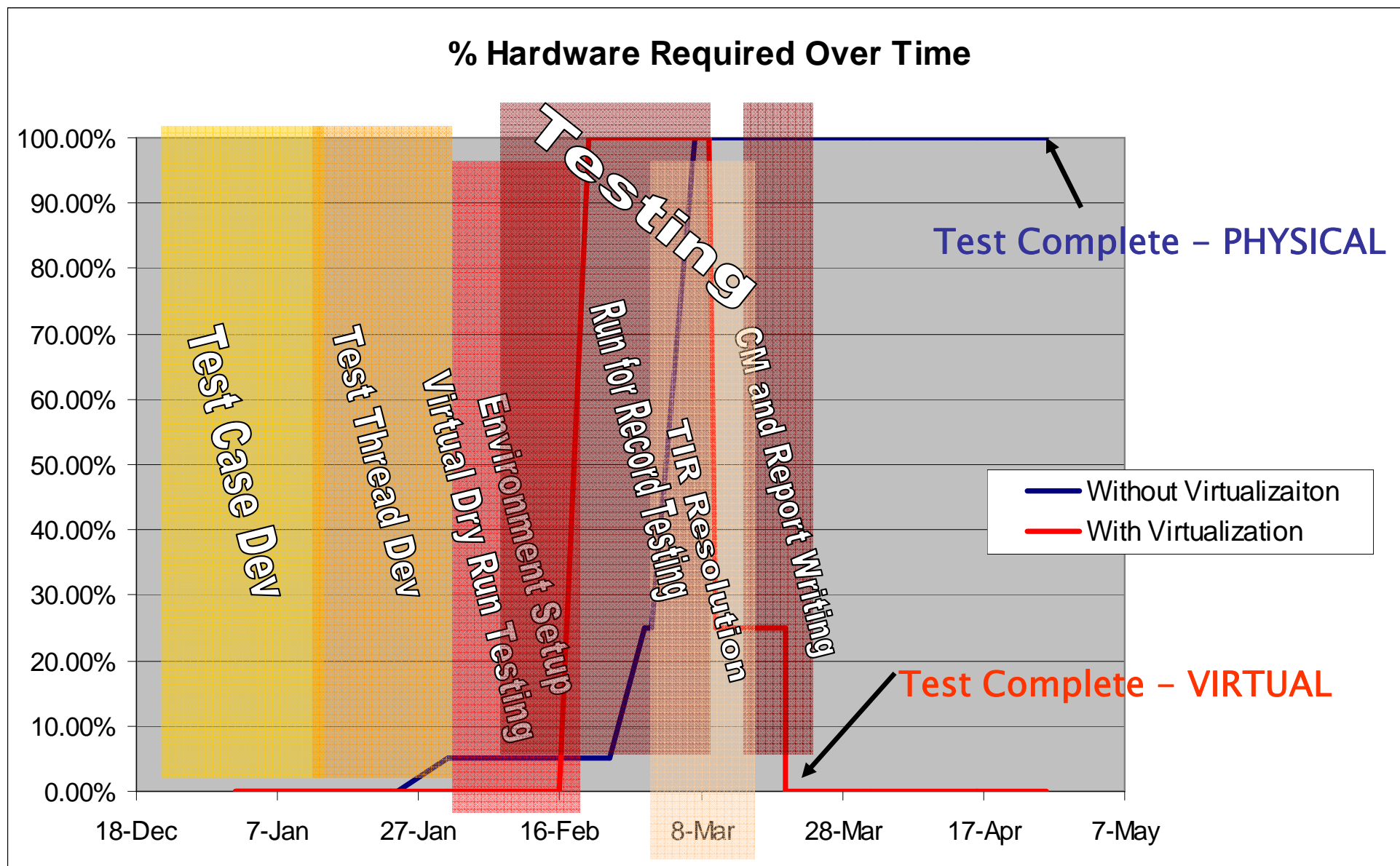


A Notional (All Physical) Test





Virtualization Supported Testing (SAME SCALE)





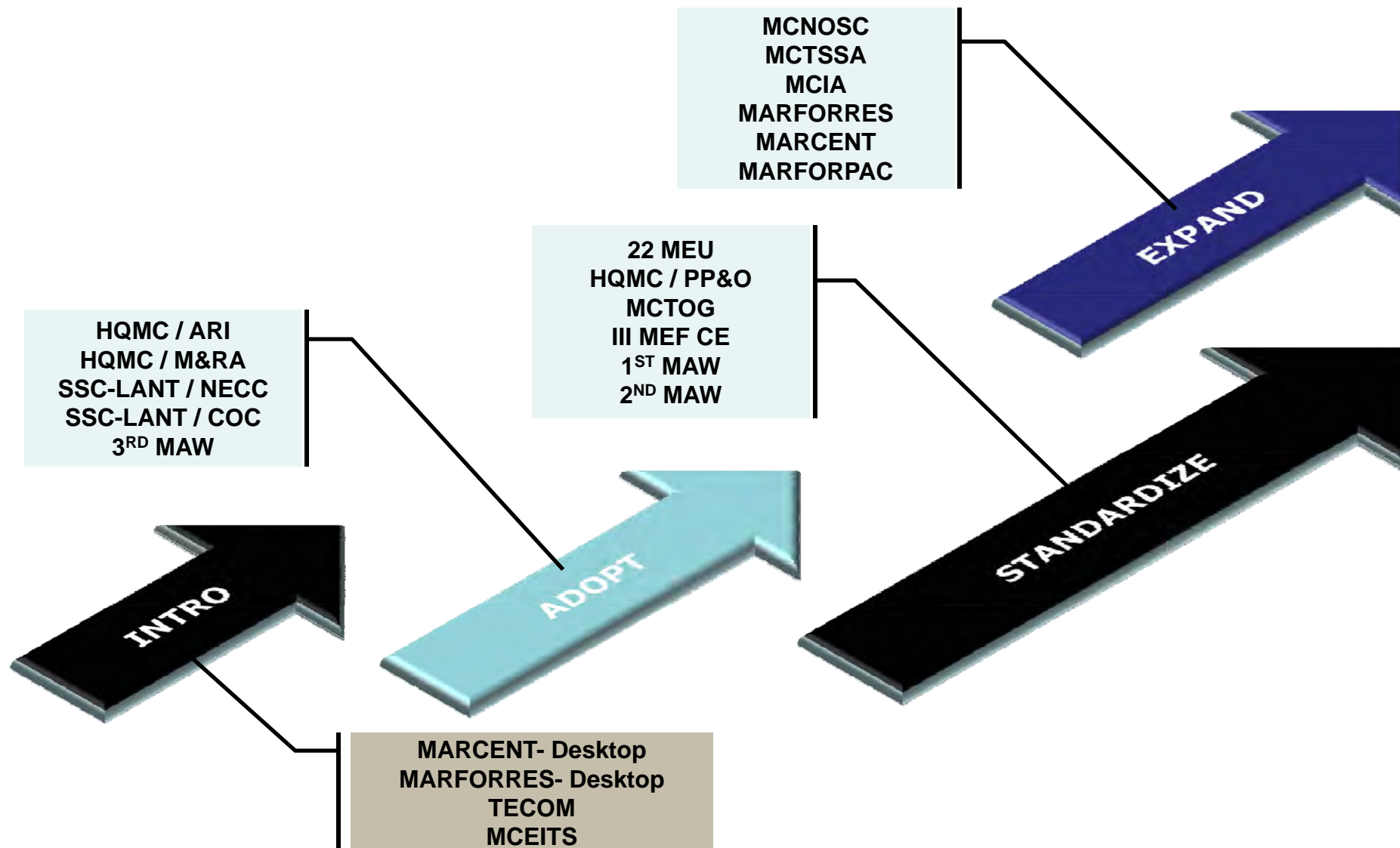
Marine Corps Use of Virtualization



- Tactical Collaborative Work Suite ([TCWS](#))
 - 20+ virtual servers hosted on 5 physical servers
- Data Delivery System-Replacement and Modular (DDS-R and DDS-M)
 - 2 physical servers with a storage area network (SAN)
- Combat Operations Center (COC)
 - COC is virtualizing.
- Expeditionary Fighting Vehicle (EFV) Command and Control variant
 - Virtualizing servers for continuity of operations
- MCNOSC & MITSCs
 - Fully virtualized (as much as possible)
- Over 1,000 VMs in Iraq and Afghanistan right now.



Relative Overall Progress





MCTSSA/Marine Corps Industry Cooperation



- Non standard use cases
 - Much of what MCTSSA virtualizes is client based
 - The Marine Corps is doing a lot of server based virtualization, but ruggedized and expeditionary in nature.
 - Combat Operations Center and the Expeditionary Fighting Vehicle both use the TACLINK 3000, non standard interface
 - Many of the C4I assets in the Marine Corps inventory also use non-standard interfaces.
 - Very inexperienced systems administrators with high turnover.



Where MCTSSA is



- Current use of virtualization – Virtualization of clients and servers in the C4I architecture in order to create a virtual Marine Expeditionary Force to develop, test and certify C4I assets and to allow more efficient testing with real assets.
- Have virtualized:
 - Intelligence Operations Workstation (IOW) V1/V2,
 - Intelligence Operations Server (IOS) V3,
 - Command and Control Personal Computer
 - Joint Tactical Collaborative Workstation (JTCW)
 - InterTEC Tool Suite,
 - C3Driver Tool Set,
 - Combat Operations Center (COC) and Command Post of the Future (CPOF)
 - Researching Sun SPARC virtualization and more.



Where MCTSSA Is



- Support Center
 - VMs used for training at the Support Center.
 - Support Center designated the Tier 1 Help Desk for virtualization issues in the Marine Corps.
- Deployed Support
 - Deployed support teams already receiving training on virtualization IOT help the Operating Forces while deployed.
 - Deployed Support now has their own sandbox lab
- Test Branch
 - Used virtual machines for validating and vetting test threads and operator training in MC3T and JTCW tests.



Where MCTSSA Is Going



- Virtualization Center of Excellence
 - A place where all aspects of virtualization in garrison and tactical areas can be explored, researched, developed, tested and supported through all phases and aspects of the acquisition cycle.
 - Tactical use and integration of virtualization for continuity of operations and lessen footprint/lighter loads.
 - Garrison development, use testing and support of virtualization solutions, including all aspects of software and hardware related to the many add-on software packages developed for VMware virtualization solutions
 - Research and development of non-VMware, non-standard virtualization technologies to meet the Marine Corps current and future use cases.
 - Development of best practices, deployed support teams trained in virtualization and 24/7/365 global reach back to trained virtualization administrators with the capability of rapidly fixing almost any problem.



Take Aways



- Use of Virtual Machines is in support of and does not replace testing with and of real machines, except when used as simulation/stimulation in a test.
- Shortens time required for physical test by identifying and mitigating of incidents in virtual environment before physical environment is even built.
- Virtualization in support of physical testing results in a much more efficient use of physical gear
 - Minimize time the gear is sitting in the physical environment
 - Minimizes the need for physical gear in thread development and vetting, operator training, dry run testing and troubleshooting
- More tests with the same amount of gear and less money



But Wait, There's More



- **Use of Virtual Machines is in support of and does not replace testing with and of real machines, except when used as simulation/stimulation in a test?????**
- DoD Policy is that if any simulation is used in an acquisition program it must be verified, validated and accredited (VV&A)
 - What if the system was developed originally as a VM, or if it spent part of it's life in development as a VM and then was deployed as a physical box?
 - What if the system is deployed as a VM or set of VMs? (NECC)
 - The line is increasingly becoming blurry
 - Even if the system is deployed as a VM, certain caveats must be set (RAM reservations, CPU reservations, hard disk size, etc...)



QUESTIONS ?



Word to the Wise



- Don't believe the hype
 - There can be some serious digressions from reality when you speak with folks from differing camps or vendors
 - Do your own research, don't rely on vendors to tell you the truth
- Proof of Concept is cheap, implementation probably won't be
- Invest in some sort of higher quality shared storage for business critical production use to ensure you can take advantage of the disaster recovery and continuity of operations use cases
- Good high speed networking is essential for anything other than simple proof of concept use
- Open source virtualization has some interesting offerings



Virtualization Links

- VMware
 - www.vmware.com
- Citrix and Xensource
 - www.xensource.com
- Hyper V
 - <http://www.microsoft.com/windowsserver2008/en/us/hyperv.aspx>
- Sun (Solaris-based)
 - <http://www.sun.com/solutions/virtualization/>
- Oracle (mostly for DB)
 - <http://www.oracle.com/virtualization/index.html>
- There are many, many more....